Hazard Profile – Wildland Fire

Introduction[1, 2, 3, 4, 5, 6]

Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property.

The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event; however, wildland fires have occurred in every month of the year. Drought, snow pack, and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires. Lightning generally is the cause of most fires in the peak fire period of July, August and early September.

Short-term loss caused by a wildland fire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds; vulnerability to flooding increases due to the destruction of watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure.

The Washington Department of Natural Resources protects 2.5 million acres of state-owned land and 10 million acres of land in private ownership through legislative directive [RCW 76.04].

The department fights about 1,000 wildland fires per year across the state; about 70 percent are in Eastern Washington. Most are small, usually extinguished while they are less than one acre in size. People start most wildland fires on state lands; major causes include arson, recreational fires that get out of control, smoker's carelessness, debris burning, fireworks and children playing with fire. The major cause of fires on federally protected lands is lightning.

Wildland fires can spread to more than 100,000 acres, depending on a number of factors, and may require thousands of firefighters and several months to extinguish. Federal, state, county, city, and private agencies and private timber companies provide fire protection and firefighting services on forestlands in Washington.

Based on figures from 1992 to 2001 (the latest available in spring 2003), the probability of future wildland fires on state-owned or protected lands are as follows:

- Annual human-caused fires – More than 500, burning about 4,404 acres total.
- Annual lightning-caused fires – More than 135 fires, burning about 10,866 acres total.

Factors that influence wildland fire

A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of

available fuel, weather conditions, and terrain.

- Fuel:
  - Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite.
  - Snags and hazard trees – those that are diseased, dying, or dead – are larger west of the Cascades, but more prolific east of the Cascades. In 2002, about 1.8 million acres of the state's 21 million acres of forestland contains trees killed or defoliated by forest insects and diseases.

- Weather:
  - West of the Cascades, strong, dry east winds in late summer and early fall produce extreme fire conditions. East wind events can persist up to 48 hours with wind speed reaching 60 miles per hour; these winds generally reach peak velocities during the night and early morning hours.
  - East of the Cascades, summer drying typically starts in mid June and runs through early September, with drought conditions extending this season. Passage of a dry, cold front through this region can result in sudden increase in wind speeds and a change in wind direction affecting fire spread.
  - Thunderstorm activity, which typically begins in June with wet storms, turns dry with little or no precipitation reaching the ground as the season progresses into July and August. Thunderstorms with dry lightning are more prevalent in Eastern Washington.

- Terrain:
  - Topography of a region or a local area influences the amount and moisture of fuel.
  - Barriers such as highways and lakes can affect spread of fire.
  - Elevation and slope of landforms – fire spreads more easily as it moves uphill than downhill.

The peak burning period of a fire generally is between 1 p.m. and 6 p.m., with local factors (generally described above) greatly influencing this. Wildland fires can take on a life of their own when there is plenty of heat and fuel. They can create their own winds and weather, generating hurricane force winds of up to 120 miles per hour. Fires can heat fuels in their path, drying them out, and making them easier to ignite and burn.

Fire Seasons

The fire season typically is longer in Eastern Washington than in Western Washington; fuel moisture and ignition sources play the most significant roles in the difference.

- The eastern half is drier; the western half of the state receives more rainfall, and has spring seasons that are wetter and cooler than the east.

- Eastern Washington has a larger number of ignition sources, primarily the number of lightning strikes.

Impact of Wildland Fire on State-Owned or Protected Land[7]

The direct impact of wildland fire on state-owned or protected lands from 1992 through 2001 (the most recent fire seasons for which statistics are available) was more than $191 million dollars.

Wildland fires caused more than $103 million in damage during this 10-year period. The bulk of the losses were harvestable timber and timber products valued at more than $74 million. Fire destroyed forage, wildlife, watersheds, and recreation areas valued at more than $14 million, and real and personal property worth more than $15 million.

Data on indirect impacts of wildland fire, such as the economic loss caused by reduced revenue and tax receipts from reduced timber and crop sales or leasing of rangeland, is not available.

Fighting nearly 8,700 fires on more than 175,500 acres of state-owned or protected lands cost federal, state and local agencies and Indian tribes nearly $88 million during this 10-year period.

Significant Wildland Fires Since 1900[8, 9, 10, 11, 12]

Table 1, below provides information on some of the most significant wildland fires in Washington since 1900. This includes fires on lands of all ownership – federal, state, local, private, and Indian tribe.

Table 1. Significant Wildland Fires Since 1900

Year	Fire	Area	Acres Burned	Impacts
1902	Yacolt	Skamania, Clark Counties	238,900	38 deaths.
1910	Great Idaho Fire	Spokane and Pend Oreille Counties	150,000	3 million acres burned, mostly in Idaho and Montana; considered one of the nation's historically significant fires.
1929	Dole Valley	Skamania, Clark Counties	227,500	
1929	Toats Coulee	Okanogan County	80,000	
1951	Great Forks Fire	Clallam County	33,000	Fire threatened Forks leading to evacuation of the town. A sawmill, and a number of homes, cabins and barns destroyed.

Table 1. Significant Wildland Fires Since 1900

Year	Fire	Area	Acres Burned	Impacts
1970	Lightning Bust	Chelan, Okanogan Counties	188,000	
1985	Barker Mountain	Okanogan County	60,000	
1987	Hangman Hills	Spokane	1,500	2 deaths; 24 homes destroyed.
1988	Dinkelman	Chelan County	50,000	1 death.
1991	Firestorm 1991	Ferry, Lincoln, Stevens, Pend Oreille, Spokane, and Whitman Counties	35,000	92 fires destroyed 114 homes and 40 buildings, another 250-300 buildings damaged, one death. Fires started by arcing electrical connections, spread over wide area by high winds. Federal Disaster #922. Stafford Act disaster assistance provided: $12.3 million.
1992	Skookum	Klickitat County	51,000	
1992	Castlerock Canyon	Wenatchee		24 homes destroyed.
1994	Tyee Creek, Hatchery Creek, Rat Creek, Round Mountain	Chelan County	180,000	2,700 homes threatened and evacuated, 37 homes destroyed.
1996	Cold Creek	Benton, Yakima Counties	57,000	
2000	24 Command	Hanford Site, Benton County	192,000 (160,000 on Hanford Site)	Caused by vehicle accident, spread to Hanford Site; 36 structures lost. Burned across three radioactive waste disposal sites, no radioactive release detected. Fire came within two miles of 177 underground storage tanks filled with lethal radioactive waste.
2000	Mule Dry	Yakama Indian Reservation and Yakima, Klickitat, and Benton Counties	76,800	1 home destroyed.
2001	Rex Creek Complex / Virginia Lake Complex	Colville Indian Reservation and Chelan, Ferry, Okanogan Counties	130,000	Hundreds of homes threatened, 10 destroyed.
2001	Thirtymile	Okanogan	9,300	4 firefighters died.

Major Wildland Fires on State-Owned or Protected Lands, 1992-2001[13, 14]

Table 2, below, provides information on some of the most significant wildland fires on state-owned or protected lands during the 10-year period. (Note: List below generally does not include fires referenced above. Acreage burned figures are for state-owned or protected lands only; fires may have burned land under other ownership/protection.)

Table 2. Major Wildland Fires on State Protected Lands, 1992 – 2001

Year	Fire	County/Area	Acres	Impacts
1992	Skookum	Klickitat	2,600 (state protected lands only)	Fire threatened town of Goldendale.
1996	Bowie Road	Spokane	3,020	8 homes destroyed.
1997	Red Lake	Stevens	1,151	5 homes destroyed.
1998	Cleveland	Klickitat	18,500	11 homes destroyed, 143 cattle killed. Several cultural and historic sites and state natural area preserve damaged.
1999	Mallot	Okanogan	2,808	
2000	Alderdale	Klickitat	6,000	
	Rocky Hull	Okanogan	9,404	37 homes destroyed.
	Cayuse	Okanogan	5,460	
	Goodnoe	Klickitat	4,455	Destroyed pastureland, 1 barn.
	Buffalo Lake	Colville Indian Reservation	9,300	
	Wood Gulch	Klickitat	2,620	
2001	Libby	Okanogan	3,830	50 structures threatened, none lost.
	Spruce/Dome Complex	Yakima	2,442	
	Brewster Complex	Okanogan	6,154	
	Union Valley	Chelan	4,700	100 structures threatened, 3 destroyed.
	North Coppei	Columbia	4,810	

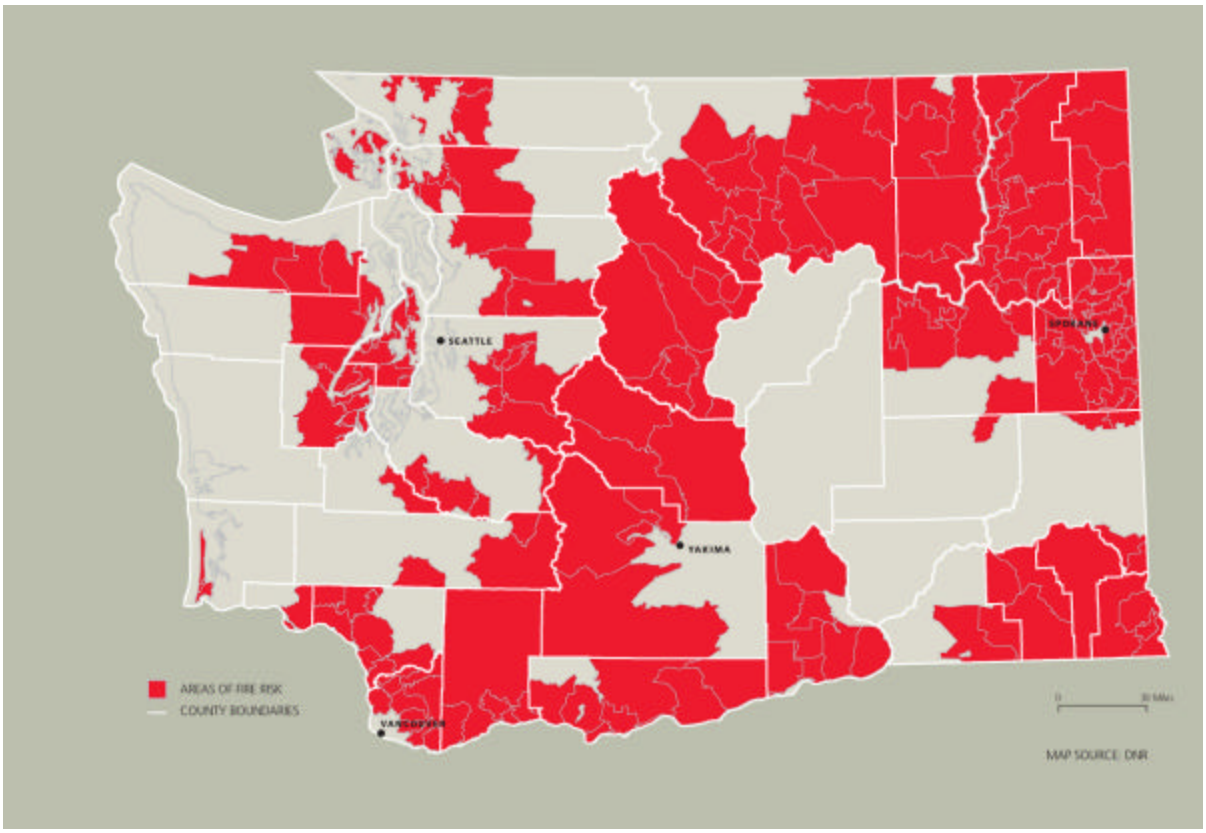
Jurisdictions Most Vulnerable to Wildland Fire[15]

The State Forester designated 181 Wildfire-Urban Interface Communities as being at high risk to wildfire. A map (page 6) and list of designated communities (page 7) follow; the red shaded area of the map depicts at-risk areas by zip code.

The Washington Department of Natural Resources and its federal and local partners determined the listed181 communities are at high risk after evaluating them for fire behavior potential, fire protection capability, and risk to social, cultural and community resources. Risk factors included area fire history, type and density of vegetative fuels, extreme weather conditions, topography, number and density of structures and their distance from fuels, location of municipal watershed, and likely loss of housing or business. The evaluation used the criteria in the wildfire hazard severity analysis of the National Fire Protection Association's NFPA 299 Standard for Protection of Life and Property from Wildfire, 1997 Edition.

The counties in which these jurisdictions lie are:

Adams	Asotin	Benton	Chelan	Clallam	Clark	Columbia
Cowlitz	Ferry	Garfield	Jefferson	King	Kitsap	Kittitas
Klickitat	Lewis	Lincoln	Mason	Okanogan	Pacific	Pend Oreille
Pierce	San Juan	Skagit	Skamania	Snohomish	Spokane	Stevens
Thurston	Wahkiakum	Walla Walla	Whatcom	Whitman	Yakima	



Source: *Progress Report on the National Fire Plan in Washington State*, Department of Natural Resources, September 2002.

Urban Interface Communities at High Risk to Wildfire

9-Mile Rogers Bar
Acme
Addy
Allyn
Amboy
Ariel
Arlington
Ashford
Bainbridge Island
Baring
Battle Ground
Belfair
Bellingham
Bickleton
Bingen
Boyds
Bremerton
Brewster
Brinnon
Brush Prairie
Burlington
Camas
Cameron Lake
Carlton
Carnation
Carson
Cashmere
Castle Rock
Cathlamet
Centerville
Chattaroy
Cheney
Chewelah
Clayton
Cle Elum
Colbert
Colville
Cowiche
Curlew
Cusick
Dayton
Deer Park
Deming
Desautel
East Wenatchee
Eatonville
Elbe
Elk
Ellensburg
Elma
Entiat
Enumclaw
Etueville
Evans
Fairchild AFB
Fall City
Ford
Ford Cluster
Fort Simcoe Job Corp Center
Friday Harbor
Fruitland
Georgeville
Gifford
Goldendale
Granite Falls
Grapeview
Greenacres
Hansville
Highway 97 Corridor
Hoodsport
Hunters
Ilwaco
Inchelium
Issaquah
Kalama
Keller
Kelso
Kettle Falls
Kingston
Klickitat
Lake Roosevelt Corridor
Leavenworth
Liberty Lake
Lilliwaup
Long Beach
Long Island
Longview
Loomis
Loon Lake
Lyle
Malaga
Malo
Manson
Marblemount
Matlock
Mazama
Mead
Medical Lake
Methow
Mica
Monroe
Moses Meadows
Mossyrock
Naches
Naselle
Nespelem
Newman Lake
Newport
Nine Mile Falls
North Ahtanum
North Bend
Ocean Park
Okanogan
Olalla
Olga
Olympia
Omak
Oroville
Otis Orchards
Packwood
Pateros
Peshastin
Pomeroy
Port Angeles
Port Hadlock
Port Orchard
Port Townsend
Poulsbo
Quilcene
Randle
Ravensdale
Reardan
Republic
Reservation Road
Rice
Ridgefield
Riverside
Rockford
Roosevelt
Roy
Seabeck
Selah
Sequim
Shelton
Silverdale
Silverlake
Skykomish
Snoqualmie
Spangle
Spokane
Springdale
Stehekin
Stevenson
Sultan
Suquamish
Tahuya
Thorp
Tieton
Tonasket
Toutle
Tumtum
Twin Lakes
Twisp
Underwood
Union
Usk
Valley
Valleyford
Vancouver
Veradale
Waitsburg
Washougal
Wauconda
Wellpinit
Wenatchee
White Salmon
Winthrop
Woodland
Yacolt
Yakima
Yakama Indian Nation
Yelm

State Agency Structures At Risk			PRELIMINARY ASSESSMENT
Number and Function of Buildings	**No. of Affected Staff / Visitors / Residents**	**Approx. Value of Owned Structures**	**Approx. Value of Contents All Buildings**
Total at-risk buildings: State agencies participating in this plan identified 843 facilities as being potentially at-risk to direct damage or to the indirect impacts of wildland fire (utility services reductions, transportation restrictions, etc.).	63,388	$1,544,872,212	$1,650,045,436

Function of at-risk buildings: Included in the state facilities potentially at-risk to wildland fires are the following:

- Main campus of Western Washington University and its marine laboratory.
- University of Washington's Pack Forest campus.
- Regional headquarters, local detachments, highway weigh scales, and communication facilities of the Washington State Patrol.
- Campuses of Francis Haddon Morgan, Eastern State Hospital, Yakima Valley School and Lakeland Village for individuals with physical and mental disabilities.
- Campuses of Naselle Youth Camp and Echo Glen Children's Center *for* juvenile offenders.
- Campuses of Big Bend Community Coillege, South Puget Sound Community College.
- More than 400 general office and client service offices, primarily in Western Washington, that include those serving individuals and families on public assistance, providing employment and training services, driver licensing, and liquor sales.

Total at-risk critical facilities: State agencies participating in this plan identified 408 critical facilities as being potentially at-risk to direct damage or to the indirect impacts of wildland fire (utility services reductions, transportation restrictions, etc.).	46,163	$1,191,840,831	$1,336,979,942

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[1] *Washington State 2001 Hazard Identification and Vulnerability Assessment*, Washington State Military Department, Emergency Management Division, April 2001.

[2] Untitled document in *The Winning Series* describing the fuels, strategy, tactics, special safety and logistical concerns in the Pacific Northwest, Wildfire Lessons Learned Center, National Wildfire Coordinating Group, <http://www.wildfirelessons.net/Winning_Series.htm>, (August 5, 2003).

[3] Washington Department of Natural Resources, annual fire statistics, 1992 – 2001.

[4] *Washington Forest Health Issues in 2002*, Washington Department of Natural Resources, <http://www.dnr.wa.gov/htdocs/rp/forhealth/issues/2002issues.htm>, (August 1, 2003).

[5] Oral communication from Bob Bannon, Natural Resource Program Section Administrator, Resource Protection Division, Washington Department of Natural Resources, August 1, 2003.

[6] Written communication from Jennifer Flemister, Resource Protection Division, Washington Department of Natural Resources, November 14, 2003.

[7] Washington Department of Natural Resources, annual fire statistics, 1992 – 2001

[8] Ibid.

[9] *Washington Wildfire Mitigation Plan*, Washington Department of Community Development and Washington Department of Natural Resources, May 1994.

[10] *Firestorm '91 And Wind Mitigation Survey Report, FEMA-922-DR-WA*, Washington Department of Community Development and Washington Department of Natural Resources, November 1992.

[11] Washington State Emergency Operation Center incident records, Washington Emergency Management Division, 1994 – 2001.

[12] Written communication from Paul Hampton, Resource Protection Division, Washington Department of Natural Resources, November 17, 2003.

[13] Washington State Emergency Operation Center incident records, Washington Emergency Management Division, 1994 – 2001.

[14] Washington Department of Natural Resources, annual fire statistics, 1992 – 2001

[15] Originally published in *Federal Register*, Volume 66, Number 100, pages 43432-43433, August 17, 2001, and updated by the Washington Department of Natural Resources in *A Progress Report on The National Fire Plan in Washington,* 2002.